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ABSTRACT

This study investigated the effect of various dimensions of classroom structure on children's reading skills. Two classrooms each from grades one to three were selected by district administrators as outstanding examples of different types of classroom structure. A sample of 16 children was drawn from each class. Each classroom was observed on the same two days of the week, for three consecutive weeks, by trained observers using instruments that focused separately on teacher and student behaviors. The Wide Range Achievement Test was administered in the fall and again in late spring. Among the findings were that there were significant relationships between growth in reading and classroom openness, student involvement, and student responsibility for learning. Negative correlations were found between growth in reading and both the amount of teachers' controlling behaviors and positive emotional tone. (AA)

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Hermine H. Marshall Variations in Classroom Structure and Growth in Reading*¹

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The purpose of this study is to investigate the effect of various dimensions of classroom structure and functioning--including those associated with both open and traditional classrooms--on children's learning, with particular focus on reading skills.

Recent reviews of research on the relationship between student outcomes and such classroom variables as classroom structure reveal inconsistent results (Dunkin and Biddle, 1974; Rosenshine, 1976). While some studies (e.g. Solomon & Kendall, 1976; Wright, 1975) report greater achievement in traditional classrooms, others report either no difference (Crandall, 1973) or no clear pattern (Tuckman, Cochran & Travers, Note 1). Although not directly comparing open and traditional classrooms, studies of Follow Through classrooms by both Soar (Note 2) and Stallings (Note 3) show a tendency for higher achievement scores to be associated with variables reflecting the more structured and teacher-initiated variables. Other studies show differences according to student variables. For example, Ward and Barcher (1975) found that high IQ students in traditional classrooms had higher reading achievement scores than high IQ students in open classrooms, but that there were no differences between low IQ students in open and traditional classrooms nor between low IQ students and high IQ students in open classrooms. Solomon and Kendall (1976) also report differences in achievement depending on student characteristics.

Among the possible reasons for these inconsistent findings may be the

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type of student outcome measure generally utilized: group administered standardized achievement tests. A number of reviewers have pointed out the inappropriateness of utilizing standardized testing situations for assessing nontraditional programs (Shapiro, 1973; Stodolsky, 1972). Students in nontraditional classrooms are less accustomed to doing the same thing simultaneously within rigid time limits and without helping each other. In addition, traditional curricula appear more effective when measured by traditional tests, whereas new curricula appear more effective when tests measure content reflecting the new curricula (Tuckman, et al., Note 1; Walker & Schaffarzick, 1974).

Inconsistent results may also be due to the use of different measures of classroom structure by different investigators as well as to the limitations of many of these measures. In some studies (e.g. Ward and Barcher, 1975; Wright, 1975), questionnaires such as the DISC (Musella, Note 4) have been used. Questionnaires (e.g. Musella, Note 4; Walberg & Thomas, 1972) are limited to the extent that teachers' responses reflect their conception of an ideal classroom and/or their perceptions of the "correct" response rather than reality. Other investigators have utilized observational techniques, including global ratings scales (Solomon & Kendall, 1976) or sign and category systems (e.g. Soar, Note 2). Global rating systems (e.g. Solomon & Kendall, Note 5) which require the observer to make inferential judgments are usually handicapped by the halo effect common to high-inference rating scales. Some measures of classroom openness (e.g. Walberg & Thomas, 1972) are restricted by their emphasis on easily observable behaviors. (See Marshall, Note 6; Walberg & Thomas, 1975).

A third possible factor influencing the reported lack of consistent relationships is the use of research designs which do not adequately sample

or control for the activities occurring in the classroom during the observations. Even in those studies which utilize observational techniques, observations usually have been brief, generally in the range of one hour on four days (Solomon & Kendall, 1976) to one full day (Soar, Note 2). In some studies, classrooms were observed at random time periods (e.g. Wright, 1975). Because classroom behaviors may fluctuate systematically with the subject matter of the lesson (Marshall, Green & Lawrence, Note 7), failure to control for the subject matter content during observations may have contributed to the appearance of instability of classroom variables (Medley & Mitzel, 1963; Rosenshine, 1970) and to the inconsistency of results.

This study was designed, therefore, to utilize (a) a measure of student learning which would be equally appropriate for students in either traditional or open classrooms, (b) a broad range low-inference classroom observation system applicable to both traditional and open types of classrooms; and (c) an observation schedule which takes into account the subject matter content of the lesson.

Method

Subjects

Six primary classrooms (two from each of grades 1-3) from a middle-class suburban area were selected by district administrators as outstanding examples of different types of classroom structure. The classrooms ranged from open (defined as using "flexible learning centers and a more individualized and interdisciplinary approach") to traditional (defined as using "a high degree of structure as exemplified by two or three groups for reading, spelling, and math"). The teachers were then interviewed by an outside interviewer who was uninformed as to the purposes of the study and the process of teacher selection. This outside expert ranked the classrooms on a dimension of openness to traditionalness (Marshall, 1972).

All of the teachers were female and had a minimum of five years' teaching experience.

A random sample of 16 Caucasian students, 8 boys and 8 girls, was drawn from each classroom. Students considered by the teachers to be educationally handicapped were excluded from the study.

Instruments

Dimensional Occurrence Scale (DOS). For purposes of this study, an instrument was developed to overcome many of the inadequacies of previous attempts to study open and traditional classrooms. This instrument, the Dimensional Occurrence Scale (DOS) is used to rate the occurrence of clearly defined observable behaviors which require the observer to make a minimal amount of inference regarding the evidence for or interpretation of these behaviors. As suggested by Dunkin and Biddle (1974), the low-inference behavioral rating items on the DOS have been combined into higher inference variables which reflect the broader cognitive, affective, and structural aspects of the classroom.² Table 1 lists these variables together with examples of the low-inference behavioral rating items comprising each variable.

The Dimensional Occurrence Scale is divided into two sections: (a) the Teacher-DOS or T-DOS (64 items) and (b) Student-DOS or St-DOS (54 items). This format allows the observer to attend first to the teacher for a 16-minute observation period and then to the student for a 16-minute observation period, thus providing two vantage points from which to examine the teacher's behavior and purpose.

The behaviors are rated on one of three types of 5-point scales: (a) the amount of time during the observation period that the behavior occurs, ranging from 1- "no occurrence of the behavior observed" to 5-

"behavior occurred during the entire period;" (b) the number of times certain infrequently occurring behaviors occurred, ranging from 1- "no occurrence observed" to 5- "seven or more occurrences of the behavior were observed;" and (c) the number of students exhibiting the behavior (St-DOS only), ranging from 1- "less than one-fourth of the students present exhibited the behavior" to 5- "three-fourths or more of the students present exhibited the behaviors." A complete description of the DOS and procedures for use are given in the Manual (Marshall, 1976).

Interrater agreement (reliability) between three trained observers was calculated for each item using three methods: (a) Ebel's intraclass correlation (Guilford, 1954), (b) a measure of explained variance (Marascuilo, 1971), and (c) percent of agreement. Six unreliable items--all on the T-DOS--were excluded from subsequent data analysis. The procedures for determining interrater agreement and the decision to exclude items where the interrater agreement was unsatisfactory are elaborated elsewhere (Marshall, Note 8).

Measure of Reading

The Wide Range Achievement Test (WRAT) Level I Reading (Jastack & Jastack, 1965) was selected for use because it is an individually administered standardized reading test.³

Three types of scores were obtained from the WRAT: (a) Instructional Reading Level scores were calculated according to the standard scoring procedures described in the WRAT Manual. (b) Independent Reading Level scores refer to the child's sight vocabulary (words given automatically). This score was obtained by recording the number of words a student knew by sight as indicated by the speed with which s/he called out the word. To be scored as a sight level word, the child must demonstrate immediate

recognition of the word. (c) Skill Level scores are based on a checklist of 15 decoding skills.⁴ The testers were trained to observe the method by which students attempted to decode unfamiliar words, giving credit for knowledge of particular decoding skills, e.g. initial consonants. (See Marshall, Note 8). Scores for each skill were recorded using a three-point scale, ranging from 1-no knowledge of the skill through 2-some knowledge of the skill to 3-acquisition of the skill.

Procedures

Classroom observations. Each classroom was observed on the same two days of the week for three consecutive weeks, with each of three trained observers visiting each classroom twice. At prespecified times during each of the six mornings, three 16-minute observations were made with the T-DOS, at least one each morning during the time that Reading was scheduled. Two 16-minute observations were made in each classroom with the St-DOS, including one during the time when Reading was scheduled.

Administration of the WRAT Reading Level I. The WRAT was individually administered by two trained testers according to the standard procedures in a quiet area outside the classroom. The test was given in the Fall and again in the late Spring. Due to student absences, complete data was available for between 9 and 13 students in each classroom.

Results

Data Analysis

The data were analyzed to ascertain the relationship between reading growth and classroom structure as determined by the outside interviewer's assessment of the openness of classroom structure. In addition, the relationship between reading growth and certain classroom variables was investigated. A positive relationship with reading growth was predicted

for variables reflecting (a) Cognitive Acceptance; (b) Grouping; (c) Student Involvement, and (d) Student Responsibility for Learning. A negative relationship was expected between reading growth and (a) Noninvolvement and (b) Teacher Control. The relationship between reading growth and certain emotional tone variables was also explored.

Comparison of Initial Ability and Growth in Reading

Pretest Comparisons. To ascertain the comparability of the initial reading ability in the two classes at each grade level, pairwise comparisons were carried out on the Instructional, Independent, and Skill Level scores by means of t-tests. The means, standard deviations, and t-values for each class are shown in Table 2. No significant differences between classes on pretest were found except on the Independent Level and Skill Level scores at third grade.

Because of the differences in the Independent Level and Skill Level pretest scores and a ceiling effect found for the Skill Level posttest scores, the Instructional Level scores were used in further data analysis.

Between Classroom Comparison of Growth Scores. To compare reading growth across all six classrooms, each student's Fall Instructional Level score was subtracted from his/her Spring Instructional Level score. Analysis of variance, followed by pairwise comparison, were then performed on these gain or "Change" scores.⁵ Analysis of variance tables for the Instructional Level scores are shown in Table 3. Table 4 displays the means and standard deviations. Significant differences were found ($F_{(5,58)} = 5.20, p < .05$), with pairwise comparisons indicating that the students in class C gained significantly more than those in classes F, E, and H (CAKFEH).⁶

Differences in Reading Growth according to Classroom Structure

To investigate the relationship between the type of classroom structure

and growth in reading, the independent interviewer's analysis of the openness of classroom structure was utilized. Classroom C was ranked most open, followed by classroom A, then F. Classroom K was considered an example of a good traditional classroom, while classrooms E and H were characterized as "not so good" examples of traditional classrooms.

Kendall's rank order correlations were calculated between the ranks on Instructional Level Change scores and the ranking on openness (C,A,F,K,E = H). A statistically significant agreement between the ranking on openness and growth in reading was found ($\tau = .83, p < .01$).

Relationship of Growth in Reading to Classroom Variables

To determine the relationship between reading growth and classroom variables of interest, Kendall's rank order correlations were calculated between the Instructional Level Change scores and ratings obtained on those DOS variables for which a relationship with reading growth was anticipated. The DOS ratings during Reading period were used in this analysis because a more direct relationship was expected between reading outcomes and classroom behaviors during Reading than during all periods combined, regardless of whether reading was occurring or not. The correlation coefficients are presented in Table 5.

Cognitive Acceptance and Grouping Variables (T-DOS). Correlations between reading and both the cognitive acceptance and grouping (small groups) variables were not significant.

Student Involvement and Noninvolvement (St-DOS). As predicted, a significant positive correlation was found between reading growth and student involvement ($\tau = .75, p < .05$). Conversely, a negative correlation which approached significance was found between reading and the noninvolvement variable ($\tau = -.55, p < .10$).

Responsibility for Learning (T-DOS and St-DOS). Consistent with our expectation, a positive correlation was found between growth in reading and the teacher's allowing the student some responsibility for learning (T-DOS) ($\tau = .60, p < .05$). Conversely, a negative relationship which approached significance was found between reading and the teacher taking responsibility for directing learning (T-DOS) ($\tau = -.47, p < .10$).

However, when correlations were calculated between the reading scores and the similar variables as measured by the St-DOS, student responsibility for learning was found to be negatively correlated with reading ($\tau = -.64, p < .05$). The correlation between reading and teacher responsibility for learning on the St-DOS was nonsignificant.

Teacher Control (T-DOS). Supporting the prediction, the negative correlation between reading and the amount of teacher controlling behaviors was significant ($\tau = -.64, p < .05$).

Emotional Tone (T-DOS). A negative correlation was found between reading and the positive emotional tone variable ($\tau = -.60, p < .05$).

Discussion

Some of the results of this study support those of previous research, while others do not.

Greatest gains were made in those classes which were considered most open. The classes where the least growth occurred were described by the outside interviewer as "not so good traditional classrooms" -- despite the criteria for selection. The classes where the students made an intermediate amount of growth were described as a class which was "moving towards openness" and a "good traditional classroom." Thus, classroom structure as well as the adequacy of implementation appear to be associated with reading growth.

Concerning the more specific dimensions comprising classroom structure, greatest growth in reading occurred in those classrooms where students were involved in the learning task during the reading period--consistent with the results of previous studies (Stallings, Note 3; Solomon & Kendall, Note 5). These results also appear to support the current emphasis on the importance of "academic engaged time" (e.g. Rosenshine & Berliner, in press).

However, in contrast to previous studies (Soar, Note 2; Stallings, Note 3), greater growth in reading occurred in those classrooms where the teacher allowed choices and was flexible regarding procedures. The fact the St-DOS Student Responsibility for Learning variable was negatively correlated with reading growth may be attributable to the slight difference in the items comprising the variable. It may be that there is a crucial difference between the teacher's allowing for choice within a set of specific learning activities (T-DOS items) and students having a voice in planning activities (St-DOS items).

Less growth in reading occurred in classrooms where the teachers exhibited many controlling behaviors, e.g. overt verbal control, nonverbal control, redirection. It is possible that where such control techniques were necessary, control problems existed which detracted from the learning task. These results are consonant with previous research which reports that learning is associated with control and orderliness (Solomon & Kendall, Note 5) and with management techniques which prevent problems (Brophy & Evertson, 1974).

The failure of our results to support our hypothesis concerning the effect of the teacher working with small groups is not consistent with some previous research (Rosenhine, 1976). However, it may be that grouping

per se is less important than the type of instruction that occurs within the group.

Similarly, the failure to find an association between reading growth and the cognitive acceptance variable, which includes teacher acceptance of student responses and mistakes and the encouragement of open expressiveness, suggests that encouragement of open expressiveness during reading period may detract from the task of learning reading skills.

The negative relationship between positive emotional tone and reading found in this study may be attributable, in part, to the select nature of the teachers in the sample. Our observers recorded very few instances of negative emotional tone. However, previous studies have often shown no clear relationship between student outcomes and such positive emotional tone variables as praise (Dunkin & Biddle, 1974; Rosenshine, Note 9).

Certain differences in conceptualization, procedures and research design may also explain the discrepancies between our results and those of other research.

One source of the divergence between our findings and those of other researchers may be related to differences in definition and interpretation of types of classroom structure. In his reviews, Rosenshine (1976, Note 9) concludes that greater achievement is more likely to occur in classrooms with a structured approach. "Structured approaches" generally appear to be equated with a "traditional approach" to instruction, often implying that "unstructured approaches" are equivalent to nontraditional instruction. Unstructured approaches are sometimes mistakenly interpreted as synonymous with an "open classroom." However, when the items comprising an unstructured approach include "pupil freedom", "gamelike activities", "pupil uses play object as itself", "free work groups", "frequent socialization"

(Soar, Note 2), an unstructured classroom may in reality be more permissive than a well-implemented open classroom. Indeed, Solomon and Kendall (Note 5) note that although the classroom type characterized by permissiveness, lack of control and much student autonomy was found in their research to show the least achievement, this type of classroom goes beyond the description of an "ideal open classroom." Furthermore, these researchers report that the two types of classes showing greatest growth were characterized by control and orderliness. In one of these types of orderly classrooms, there were varied activities and self-initiated learning--consistent with our conception of open classrooms. The second type of orderly, controlled classroom showing learning gains was characterized as academically-oriented involving, moderately individualized, as well as warm and friendly--not inconsistent with our outside interviewer's description of our good traditional classroom. It is thus apparent that problems in categorizing and labelling different types of classroom variables may mask subtle differences in studies and contribute to the potential for misinterpretation.

Other differences in measures of classroom structure and of student outcomes as well as in the research design may also contribute to the discrepant findings. Already noted are the drawbacks of self-report questionnaires, as utilized by Wright (1975) and Ward and Barcher (1975). Although Solomon & Kendall (Note 5, 1976) used classroom observation systems, their observations were scheduled morning and afternoon on different days of the week, rather than controlling for specific lesson content. In addition, our use of an individually-administered test of reading skills rather than the group administered tests used in previous studies may be a more accurate indication of learning. Similarly, other differences, such

as the socio-economic class of the students make comparisons and generalizations difficult.

Attempting to ascertain factors influencing differences in learning tends to reveal both the uniqueness of each classroom constellation and the complexity of the classroom situation.

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Table 1

DIMENSIONAL OCCURRENCE SCALE VARIABLES AND EXAMPLES OF ITEMS¹

Categories of Variables ²	Variables	Examples of items from T-DOS	Examples of items from St-DOS
SUPPORT STRUCTURE FOR LEARNING	GROUPING	T works with small groups T gives individual attention (cognitive)	Sts work at own pace Spontaneous groups
	STRUCTURE OF SUBJECT MATTER & MATERIALS	Varied subjects Varied materials	Sts use same materials/same time Sts use text/work books
	ORIENTATION OF LEARNING ACTIVITY	T focuses on rote task T allows exploration	Sts work on convergent task Sts engage in receptive tasks
	RESPONSIBILITY FOR LEARNING	T allows choice T directs activities	Sts plan sequence Sts follow posted sequence
	EVALUATION OF LEARNING	T gives direct, immediate feedback T returns corrected work	Sts correct own work Sts record own progress
	CONTROL	T uses nonverbal control T redirects	Sts move freely Sts unruly
	ACCEPTANCE	T accepts st response T critical of st errors	
	GENERAL TONE	T praises T critical of sts	Sts smile Sts critical of others
	AFFECT	T elicits feelings T expresses own feelings	Sts express feelings
	COOPERATION		Sts cooperative Sts competitive
COMPOSITE VARIABLES	INVOLVEMENT		Sts involved in task Sts restless
	ORIENTATION TOWARDS INDIVIDUAL	T conferences with sts T accepts st errors	Individualized instruction Sts take initiative
	FLEXIBILITY	T flexible re procedures T accepts procedural suggestions	Sts plan own sequence Sts have voice in planning

¹ Only selected examples of items are listed as illustrations of each variable. Each item is explicitly defined in behavioral terms. Note that some variables are comprised of items on only the T-DOS or St-DOS but not both.

² Variables are classified into higher order categories. Composite Variables represent additional ways of grouping items. Items within the Composite Variables also appear on preceding variables.

Table 2
READING PRETEST MEANS, STANDARD DEVIATIONS, AND t-VALUES FOR EACH TYPE OF SCORE

Grade	Teacher	N	TYPE OF SCORE								
			Instructional Level			Independent Level			Skill Level		
			M	s.d.	t	M	s.d.	t	M	s.d.	t
1	F	13	15.58	4.60	.52	14.75	4.05	1.11	22.25	4.61	-.24
	A	11	14.82	1.78		13.27	1.85		22.64	2.73	
2	E	9	34.11	13.68	1.00	25.67	10.33	-1.13	35.00	6.46	-.75
	H	9	39.33	7.62		30.89	9.24		37.00	4.69	
3	K	12	50.83	13.61	-1.13	38.42	7.74	-2.03 ⁺	36.75	4.11	-2.23*
	C	11	57.36	14.13		45.91	9.95		40.18	3.16	

* $p < .05$

+ $p < .10$

Table 3
ANALYSIS OF VARIANCE FOR CHANGE SCORES

SOURCE	df	SS	MS	F	η^2
BETWEEN	5	1138.25	227.65	5.20*	.31
WITHIN	58	2537.74	43.75		
TOTAL	63	3675.98			

* $p < .05$

Table 4
Means and Standard Deviations for
Instructional Level Change Scores

Grade	Teacher	N	M	SD
1	F	13	10.50	6.43
	A	11	17.73	8.21
2	E	9	9.00	4.09
	H	9	8.67	4.47
3	K	12	13.92	6.62
	C	11	19.82	7.95

Table 5

Kendall's Rank Order Correlation Coefficients (tau):

Growth in Reading and Variables on the DOS

DOS Variable	T-DOS	St-DOS
Cognitive Acceptance	-.33	
Grouping (Small Group)	-.09	
Involvement		.75*
Noninvolvement		-.55 ⁺
Control	-.64*	
Emotional Tone: Positive	-.60*	
Responsibility for Learning: St	.60*	-.64*
Responsibility for Learning: T	-.47 ⁺	-.14

* $p < .05$ ⁺ $p < .10$

Footnotes

1. This study is a part of a larger multiple-measure research project funded in part by the Instructional Laboratories, School of Education, University of California, Berkeley. The author would like to thank Judith L. Green and Maya Tsuji Lawrence for their contributions to various phases of the project, including instrument refinement, observer training, data collection, and reading an earlier version of this paper; Nancy Roark, Lynn Tamor, and Ruth Vogt for their help in data collection; Susan Rounds for serving as the independent interviewer; Leonard Marascullo for his advice on the statistical analysis; Thomas A. Cesa for conducting the statistical analysis.

2. While the traditional way of grouping items to form variables has been to utilize a statistical procedure such as factor analysis, these techniques require large samples and are therefore inappropriate for the purposes of the present study. Hence, in order to present a picture of the surface structure of the classroom in a descriptive and understandable manner, the items on the DOS were grouped on a logical basis. An analysis of these logical groupings by means of inter-item correlations is elaborated in Marshall (Note 8).

3. The original design also called for a measure of Reading comprehension. The Gilmore Oral Reading Test (1951) was administered during the Fall testing. However, because of problems in test construction, the information was of little value. The Gray Oral was also explored in one classroom, but it, too, yielded little useful information. Through further consultation with reading specialists, we learned that no test of reading comprehension appropriate for primary grade students was currently available. Consequently, only the WRAT Level I Reading was administered in the Spring.

4. The Informal Skills Checklist was constructed by Judith L. Green.
5. Calculation of reading growth by means of analysis of covariance was also considered due to the controversy regarding gain scores. However, a preliminary test of the assumptions of linearity and parallelism underlying analysis of covariance revealed a regression coefficient of 1.16. When the regression coefficient is close to 1.00, the analysis of covariance reduces to an analysis of variance of the difference (gain or change) scores.
6. There are no significant differences between the underlined classrooms.